

Building Wire Types – Thermoset Insulation

Building Wire (sometimes referred to as “construction wire”) is usually rated 600 volts and includes some of the more common UL types: THHN, THWN, THWN-2, THW, THW-2, MTW, TW, TFN and TFFN which are thermoplastic insulated, and XHHW-2, USE-2, RHH and RHW-2 which are thermoset insulated. Thermoset insulations generally provide better high temperature performance than thermoplastic types—but are also higher in cost. The conductor size of building wire typically ranges from #14 AWG up through 1000 kcmil. This Wire Wisdom addresses thermoset cable types. Thermoplastic insulated cables are addressed in Wire Wisdom B-2.

XHHW and XHHW-2

Underwriters Laboratories (UL) Type XHHW and XHHW-2 building wires are used in residential and commercial buildings, industrial plants, utility substations and generating plants for general-purpose, control, power and switchboard wiring. These wire types can be installed in conduit or other raceways. Sizes 1/0 AWG and larger can be used in cable trays when identified with the optional UL marking “For CT Use”. Type XHHW wire can be installed in 90°C dry or 75°C wet locations. Type XHHW-2 wire can be installed in either 90°C dry or 90°C wet locations.

In 14, 12 and 10 AWG sizes the conductor can be either solid or stranded, but in larger sizes it is usually stranded in accordance with ASTM (American Society for Testing and Materials) Class B requirements. Wires and cables manufactured with compact-stranded conductors are marked on the surface with the words “compact copper” or abbreviations such as “CMPCT CU”. The conductor is typically bare (not tinned) annealed copper. The insulation is a cross-linked polyethylene compound (XLPE) which meets UL requirements.

The “X” in these types stands for “cross-linked”, the first “H” for heat resistant, the second “H” for higher heat resistance and the “W” for water resistant.

RHH, RHW-2 and USE-2

UL Types RHH, RHW-2 and USE-2 building wires are also used in residential and commercial buildings, industrial plants, utility substations and generating plants for general-purpose, control, power and switchboard wiring. In most cases, these three types

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are combined into one cable (one part number) having all three ratings. In this case, the wire is known as an RHH/RHW-2/USE-2 listed wire or cable. This “triple listed” wire can be installed in conduit or other raceways in either 90°C wet or 90°C dry locations. Sizes 1/0 AWG and larger are suitable for use in cable trays when identified with the optional UL marking “For CT Use”. Because of the USE-2 listing, it can also be directly buried.

In 14, 12 and 10 AWG sizes the conductor can be either solid or stranded, but in larger sizes it is usually stranded in accordance with ASTM Class B requirements. Wires and cables manufactured with compact-stranded conductors are marked on the surface with the words “compact copper” or abbreviations such as “CMPCT CU”. The conductor is typically bare (not tinned) annealed copper. These types are insulated with either a cross-linked polyethylene (XLPE) or an ethylene propylene rubber (EPR) compound, which provide good abrasion and crush resistance, as well as chemical and oil resistance.

The “R” in these types originally stood for “rubber”, but changed in the UL standards over the years. Now, the insulation is also permitted to be a non-rubber compound such as XLPE. As with the previous cable types, the first “H” stands for heat resistant, the second “H” for higher heat resistance and the “W” for water-resistant. The letters “USE” stand for Underground Service Entrance.

RHH and RHW-2 cable types are also permitted by industry standards to be made in 2000 volt (2 kV) rated versions. These cables have thicker insulation and are, of course, marked with a 2000-volt rating.

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